

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 1731-4108PC	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/US 00/ 27897	International filing date (day/month/year) 06/10/2000	(Earliest) Priority Date (day/month/year) 08/10/1999
Applicant LAMBDA ELECTRONICS		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 8 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☒ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☒ Certain claims were found unsearchable (See Box I).

3. ☒ Unity of invention is lacking (see Box II).

4. With regard to the title,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the abstract,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is Figure No.

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

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☐ None of the figures.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 00/27897

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claims Nos.: **5, 34, 39-41**
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
see FURTHER INFORMATION sheet PCT/ISA/210

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-4, 6, 7, 13-20, 24-26, 30-33

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-4, 6, 7, 13-20, 24-26, 30-33

A power converter with the conduction control terminal of the rectifier device being driven OFF when the current in the rectifier device is reduced to a substantially negligible amount.

2. Claims: 8, 9,

A power converter with the detection circuit including an auxiliary winding of the main transformer for sensing the voltage across the primary winding.

3. Claims: 10, 27

A power converter or a method for driving a synchronous rectifier characterized by sensing the voltage across the primary switch through a capacitor.

4. Claims: 11, 28

A power converter or a method for driving a synchronous rectifier characterized by sensing the state of a control terminal of the primary switch using a capacitor.

5. Claims: 12, 29

A power converter or a method for driving a synchronous rectifier characterized by the detection circuit including a second transformer with a sense winding connected to the control terminal of the primary switch.

6. Claims: 21, 22, 35-37,

A power converter or a method for driving a synchronous rectifier characterized by the use of two active switch rectifiers connected to the secondary of the transformer where one of the two switch rectifiers conducts current when the other switch rectifier is in a non-conductive state.

7. Claims: 23, 38

A power converter or a method for driving a synchronous rectifier characterized by the power converter being a resonant reset forward converter.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

8. Claim : 42

A method for driving a synchronous rectifier characterized by driving the synchronous rectifier with a drive signal that is modulated in amplitude as a function of the output current.

9. Claim : 43

A converter that provides an output and a bias power supply with a first and second unidirectional rectifier device, each connected to an end of the secondary winding and forming a bridge for bias power supply.

10. Claims: 44, 45

A method for establishing a maximum duty cycle for a pulse width modulator characterized by the generation of a sawtooth waveform signal using two charging currents successively, determined by the use of two impedances and switching between the two impedances.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box I.2

Claims Nos.: 5, 34, 39-41

The applicant is concerned with a power converter with a primary switch and a rectifier device being controlled by a signal that is derived from the timing of the primary switch, eventually with some delay. In claim 5 the applicant suddenly states that "said rectifier is driven ON based on a second timing signal that is independent of any timing signal representative of the switching time of said primary switch". In case of no such dependency, the primary switch and the rectifier device will not work synchronously and the two may switch ON and OFF relative to one another at any given time. A converter of that type is not covered by this application. As the primary switch and the rectifier device are in fact operating synchronously the signal for driving the rectifier device ON is dependent on the timing of the primary switch and thus on "any signal" representative of the switching time of said primary switch. Claim 39 is corresponding to claim 5 and is likewise subject to obscurity. Claims 40 and 41 are truly dependent on claim 39 and are as result also subject to obscurity.

Claim 34 specifies that "said synchronous rectifier conducts the output current when said switch is in the OFF state". Claim 34 is truly dependent on claim 30 stating that "said driving includes driving said synchronous rectifier OFF relative to said timing signal transition between levels corresponding to the switch switching between an ON state and an OFF state (thus switching the synchronous rectifier OFF controlled by the switch being switched OFF)". Claim 34 is thus inconsistent with claim 30.

The applicant's attention is drawn to the fact that claims, or parts of claims, relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure.

A. CLASSIFICATION OF SUBJECT MATTER IPC 7 H02M3/158 H02M3/335		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) IPC 7 H02M		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EPO-Internal, WPI Data, PAJ, INSPEC		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 98 54827 A (SEMI-TECH DESIGN INC.) 3 December 1998 (1998-12-03) figures 1A-3A,,11-13 ---	1,6,7, 13,14, 16,17, 19,20, 24-26
X	US 5 721 483 A (MADHAV V.KOLLURI ET AL.) 24 February 1998 (1998-02-24) abstract figure 2 column 2, line 20 - line 42 column 3, line 20 - line 26 --- -/--	1-4,6, 15,24
<div style="display: flex; justify-content: space-between;"> <input checked="" type="checkbox"/> Further documents are listed in the continuation of box C. <input checked="" type="checkbox"/> Patent family members are listed in annex. </div>		
° Special categories of cited documents :		
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p> </div> </div>		
Date of the actual completion of the international search <div style="text-align: center; font-weight: bold;">15 February 2001</div>		Date of mailing of the international search report <div style="text-align: center; font-weight: bold;">21 05. 2001</div>
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016		Authorized officer <div style="text-align: center; font-weight: bold;">LUND M.</div>

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>US 4 857 822 A (WOJCIECH A.TABISZ ET AL.) 15 August 1989 (1989-08-15) abstract figures 25,26 column 1, line 56 - line 58 column 4, line 5 - line 11 column 5, line 56 - line 58 column 7, line 18 - line 21 column 7, line 56 - line 60 column 11, line 12 - line 23 column 15, line 8 - line 44</p>	1,2,15, 18,30-33
X	<p>J.A.COBOS: "Self driven Synchronous Rectification in Resonant Topologies: Forward ZVS-MRC, Forward ZCS-QRC and LCC-PRC." 1992 INTERNATIONAL CONFERENCE ON INDUSTRIAL ELECTRONICS, CONTROL, INSTRUMENTATION AND AUTOMATION, vol. 1, pages 185-190, XP000368953 San Diego, US figures 2,5-7</p>	1,2,15, 18,30-33
X	<p>A.VITHANAGE ET AL.: "150W board mounted power supply module using highly compact and efficient synchronous rectifiers" IEEE, pages 177-183, XP000873665</p>	1,6,7,24
Y	<p>figures 5,7,8</p>	2
X	<p>US 5 920 475 A (JEFFREY L.BOYLAN ET AL.) 6 July 1999 (1999-07-06) figure 8</p>	1,6,24
Y	<p>FR 2 608 857 A (SODILEC) 24 June 1988 (1988-06-24) abstract figures 1,2</p>	2
A	<p>US 4 922 404 A (GERALD W. LUDWIG ET AL.) 1 May 1990 (1990-05-01) abstract figure 1 column 2, line 51 - column 3, line 6 column 4, line 54 - line 58 column 5, line 22 - line 26</p>	18,30-33

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9854827 A	03-12-1998	US 6055170 A AU 7608498 A DE 19882461 T	25-04-2000 30-12-1998 06-07-2000
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